August 29, 1996

MEMORANDUM

SUBJECT: Clarification of Methodology for Calculating Potential to Emit (PTE) for Batch Chemical Production Operations

FROM: John S. Seitz, Director
Office of Air Quality Planning and Standards (MD-10)

TO: See Addressees

This guidance memorandum is to clarify the Environmental Protection Agency's (EPA) policy regarding the appropriate methodology for determining PTE for batch chemical operations in light of inherent physical limitations on such sources' PTE arising from the inability of a source to use a given operation unit for the production of more than one product at a time.

Summary of Guidance

The guidance (Attachment 1) contains a discussion of the batch chemical industry and the steps for determining a source's PTE. The EPA includes as part of the guidance a document (Attachment 2) prepared by the Synthetic Organic Chemical Manufacturers Association (SOCMA). The EPA approves the methodology suggested by SOCMA, so long as the methodology incorporates an appropriate list of products and raw materials. The guidance includes a discussion of how to use the SOCMA methodology for determining major source applicability.

Distribution/Further Information

The Regional Offices should send this memorandum to States within their jurisdiction. Questions concerning specific issues and cases should be directed to the appropriate Regional Office. The Regional Office staff may contact Timothy Smith of the Integrated Implementation Group at 919-541-4718. The document is also available on the Technology Transfer Network Bullentin Board

System (TTN BBS), under "Clean Air Act, Title V, Policy Guidance Memos." (Readers unfamiliar with this bulletin board may obtain access by calling the TTN help line at 919-541-5384).

Attachment

Addressees:
Director, Office of Ecosystem Protection, Region I
Director, Air and Waste Management Division, Region II
Director, Air, Radiation and Toxics Division, Region III
Director, Air, Pesticides and Toxics Management
 Division, Region IV
Director, Air and Radiation Division, Region V
Director, Multimedia Planning and Permitting Division, Region VI
Director, Air, RCRA and TSCA Division, Region VII
Director, Office of Pollution Prevention, State and Tribal
 Assistance, Region VIII
Director, Air and Toxics Division, Region IX
Director, Office of Air, Region X

cc: Bruce Buckheit, 2242A
Randy McDonald, MD-13
Adan Schwartz, 2344
Timothy Smith, MD-12
Air Branch Chief, Regions I-X
Regional Air Counsels, Regions I-X

OECA concurred: August 22, 1996

Attachment 1

CLARIFICATION OF METHODOLOGY FOR CALCULATING POTENTIAL TO EMIT (PTE) FOR BATCH CHEMICAL PRODUCTION OPERATIONS

I. BACKGROUND

In a January 25, 1995 memorandum, the Environmental Protection Agency (EPA) addressed a number of issues related to the determination of a source's PTE under section 112 and title V of the Clean Air Act (Act). One of the issues discussed in the memorandum was the term "maximum capacity of a stationary source to emit under its physical and operational design," which is part of the definition of "potential to emit." The EPA is currently conducting category-specific analyses to address issues related to the application of the "maximum capacity" principle to specific types of sources. This memorandum provides guidance on determining the maximum capacity of batch chemical production facilities to emit in light of physical limitations on the operation of individual units at such facilities.

II. TECHNICAL GUIDANCE FOR BATCH CHEMICAL PRODUCERS

Batch chemical production operations are those in which raw materials are charged into the system at the beginning of the process, and the products are removed all at once at the end of the process. The production occurs in discrete batches, rather than as a continuous process in which raw materials are continuously being fed, and products continuously being removed. Moreover, the addition of raw material and withdrawal of product do not occur simultaneously in a batch operation. Systems in batch chemical operations consist of various equipment such as re actors, solid/liquid separators, dryers, distillation columns, extraction devices, and crystalizers, arranged in a series. The series (i.e., the particular equipment used and the sequence of that equipment) and the utilization rate (i.e., the time each piece of the equipment is in operation) may change with each different product produced (i.e., each production cycle). Many batch chemical facilities produce a wide variety of products.

Emissions from batch chemical production consist primarily of volatile organic compounds (VOC) and individual volatile organic hazardous air pollutants (HAP's). For a given batch production cycle which is used to produce a particular chemical from a given set of raw materials, emissions will occur at various unit operations in the production cycle. For a given production cycle, involving a specified set of raw materials, products, and unit operations, emission estimation methods are provided in an EPA document entitled Control of Volatile Organic Emissions from Batch Process -- Alternative Control Techniques Information Document (EPA-453/R-94-020, February 1994 (the Batch ACT).

Operation units (reactors, etc.) at batch chemical plants may not be dedicated to the production of a single chemical. Rather, the collection of operation units at a given plant site is available to manufacture a variety of different chemicals. The determination of worst-case potential emissions from batch chemical production at a given plant site, therefore, involve the following steps:

- Identification of the possible batch production cycles that reasonably could be undertaken at the plant site (i.e., determination of the equipment present, and the chemicals that could be produced with that equipment);

- For each batch cycle, determination of the VOC and individual HAP emissions; and

- Determination of the worst-case annual VOC and HAP emissions, based upon the highest emitting combination of batch production cycles that, given the facility's inherent inability to use one operations unit for more than one production cycle at a time, could be undertaken at the facility over a year's time.

These steps are discussed in detail in a document prepared by the Synthetic Organic Chemical Manufacturers Association (SOCMA). This document is included here as Attachment 2. The EPA believes that the SOCMA methodology is a reasonable procedure to use for identifying worst-case potential emissions from a given batch chemical production operation.

The EPA explicitly clarifies that in calculating the potential to emit for batch chemical operations, it is not necessary to determine the maximum emissions for a worst-case hour of operation, and to multiply that value times 8760. It is physically impossible for the process to sustain the worst-case hourly emission rate over the entire batch and so the EPA deems it appropriate to take into account variations in the emissions rate over the course of the entire cycle. For this reason, in this instance, worst-case emissions may be determined by deriving an average rate over an entire production cycle and emissions may be calculated based on the greatest number of batches that could occur in a year's time according to the methodology in Attachment 2.

The EPA's approval of the methodology in Attachment 2 should not be construed as precluding a source from proposing alternative methodologies for calculating the PTE from batch chemical operations.

III. USE OF THE GUIDANCE FOR DETERMINING MAJOR SOURCE APPLICABILITY

A. List of Products that a Source is Capable of Producing

The SOCMA methodology reflects the maximum emissions from existing equipment given a list of chemicals to be manufactured with the equipment and given the raw materials used to manufacture those products. The list of products and raw materials should include all products that the source, in the exercise of due diligence and best engineering judgment, reasonably knows that it can produce.

The best engineering judgment regarding what a source is capable of producing might consider, at a minimum:

1. Products that this source currently produces or has produced in the past;

2. Products that this source reasonably can produce without having to change the physical or operational design of the source; and

3. Products that similar sources have produced.

However, the Agency acknowledges that a batch source cannot reasonably evaluate whether it is capable of producing a particular product (or what the emissions from producing that product might be) without a certain level of process design information. Accordingly, the Agency believes that a batch source need only consider products for which, in the exercise of due diligence, sufficient information is reasonably available to generate a reasonable estimate of PTE for that product as it might be produced at the source using the estimation methods outlined in the Batch ACT.

For example, the question has been raised as to how to perform a PTE calculation for chemicals that may not yet exist, for which there is no known use in commerce, or that may be manufactured by others with similar equipment, but which the source has attempted and failed to develop a process to manufacture and so does not have sufficient information to estimate potential emissions. The Agency's response is that a rule of reason applies in each of these instances and that the PTE calculation need not include such chemicals.

Exercising its best engineering judgment as to the products that the source is capable of producing, a source would ordinarily not consider the following types of products:

1. Products that would require a change in the physical design of the source to produce;

2. Chemicals which cannot reasonably be produced, including chemicals which cannot be reasonably produced in commercially viable quantities, chemicals which are not sold in commerce, and chemicals for which no commercial market is reasonably foreseeable or for which there is no known use in commerce; and

3. Products which the source may have the theoretical physical capacity to produce, but for which the source does not have the technical knowledge necessary to produce that product

and cannot, through the exercise of reasonable due diligence, obtain the requisite technical knowledge.

This is not an exhaustive list of methods that a best engineering judgment regarding what a source is capable of producing could include. However, a list of products identified using these methods should provide a large enough list of products that, while the source may have overlooked a particular product that would be used as the worst-case product, it will likely have included another product that results in an equivalent PTE calculation.

Inherent in many of these determinations regarding the best engineering judgment as to which products a source should, or should not, include in its PTE analysis is a degree of decision making by the source. The EPA believes that a source that exercises due diligence in making these decisions under the criteria identified above will generate a PTE amount that can be relied on by both the source and permitting authorities in determining whether the source is major under the Clean Air Act's requirements. There may be additional justification as to why a particular product should or should not be included in the engineering judgment of what a source is capable of producing. In making these engineering judgments, a source that is conservative in its assumptions and takes an inclusive view as to which products it is capable of producing would have a greater degree of certainty in its determination as to whether it is major than a source that seeks to exclude products from its determination. The source that takes a more conservative approach would also be in a much better position to convince an enforcement authority that its determination regarding the products that it could produce was within the boundaries of its best engineering judgment. The Agency believes that it is in the source's best interest to be inclusive rather than exclusive in evaluating the worst-case set of chemicals that may be produced.

Clearly, however, whether or not the source is justified in excluding a particular product from its initial PTE calculation, **before manufacturing any product not included in the PTE calculation**, the source must reevaluate its PTE estimate and obtain any required permits or permit revisions. Such permitting actions might include modifications of major or minor source preconstruction permits.

B. Minor/Major Determination

Sources that have taken a conservative approach in exercising their engineering judgment regarding the products that they are capable of producing, and applied the SOCMA methodology to these products and determined that their PTE is below a major threshold level should be confident that they are an area source. A rule of reason applies to the degree of rigor to be employed in performing the analysis. For a source that concludes its PTE is just below the major source level, the EPA recommends that the source document any assumptions used in the engineering analysis, and that it exercise caution not to exclude products appropriate for inclusion under the criteria discussed above. This is particularly important when a facility has relied on a small number of products in its analysis as the possibility that an overlooked product could affect

PTE calculations is higher in this instance than if the source had used a large number of products in its PTE analysis.

For sources with PTE calculations over major threshold levels, sources can also avoid major source status by obtaining permits that limit their PTE to minor levels. These synthetic minor permits can either specify the products that a source is authorized to produce or restrict the source from producing specific products that it is otherwise capable of producing. Sources that have calculated their PTE at amounts just under a major source threshold level may also want to obtain permits with emission levels that protect them from being classified as major to avoid having to recalculate PTE as new products are developed or in the event that their engineering judgment regarding the products that they were capable of producing was in error.

C. Changes in What a Source is Capable of Producing

The situation may arise where a source learns that it is capable of producing a product that was not included in its engineering analysis at the time that the PTE calculation was performed. If this new product would raise a source's calculated PTE, and particularly where it would raise the source's calculated PTE from below major levels to above major levels, the source may have to make appropriate changes to any permit that it currently holds or obtain an entirely new permit. If the PTE will exceed that of a major source, the facility must then comply with all applicable major source requirements. However if this new product would not affect the "worst-case" PTE calculation that the source has already performed, no further actions would be required pursuant to Federal requirements although State requirements may require that the source take some action such as changing its permit terms to reflect the new product.

On the other hand, where a citizen or an enforcement authority demonstrates that the source was reasonably capable of producing the new product all along, the source could be found in violation back until the point in time at which an engineering judgment would have shown that the facility was reasonably capable of making this product. The Agency has published general guidance concerning good faith assumptions in potential to emit permitting. See the June 13, 1989 memorandum, "Guidance on Limiting Potential to Emit in New Source Permitting."

IV. CONSIDERATION OF ADDITIONAL SOURCES

The methodology in Attachment 2 relates only to emissions from batch chemical production operations. Additional sources may be present at a batch chemical plant and, if so, potential emissions from such sources should be taken into account in determining the facility's potential to emit.

Attachment 2.
HOW TO CALCULATE POTENTIAL EMISSIONS FROM A BATCH PROCESS TO DETERMINE MAJOR SOURCE STATUS

UNDER THE CLEAN AIR ACT

SECTION 1.0--INTRODUCTION

In January 1995, the Agency published guidance on several issues related to "potential to emit" (PTE). The Agency stated at that time that it would issue additional category-specific technical assistance and guidance on PTE issues.

The following guidance is being issued to assist sources that must calculate potential emissions from batch processes. The calculation of potential emissions from these facilities must consider equipment utilization rates for each product/process and their relationship to one another. The methodology is based on equipment utilization rates and the constraints that exist in using limited equipment to produce a finite list of manufactured products.

The following methodology provides for documentation of both the products manufactured and the equipment used to manufacture these products. The methodology begins with the largest emitting product/process and methodically rules out other processes that cannot be manufactured at the same time. The facility should maintain the documentation required to perform this analysis as part of its routine recordkeeping.

SECTION 2 - EMISSION ESTIMATION METHODOLOGIES

The following five step procedure should be followed to calculate potential to emit to determine if a batch processing facility is a major source. Each step is described below.

SECTION 2.1 - CALCULATION OF PRODUCT SPECIFIC ANNUAL EMISSION RATES FOR SPECIFIC EQUIPMENT TRAINS NEEDED TO PRODUCE SPECIFIC PRODUCTS (STEP #1)

The USEPA's 1994 Alternatives Control Technology (ACT) Document contains several equations for calculating emissions for various types of batch operations. In addition, the ACT Document implies that the following methodology should be used for converting these emission calculations to Annual Emission Rates (AER):

Equation 2.1:

(AER) Product M, Pollutant X =

[ACT Derived Total Emissions Per Batch x 8760 Hours/Yr]

[Time in hours required for the piece of equipment in The Batch Train that is used the most]

Where AER = Annual Emission Rate for Pollutant X for Product M to be produced in a specific batch train. (It should be noted that the above calculation assumes that Product M is the only product produced in the batch train.)

To complete Step 1, calculate the AER values for every pollutant regulated by the Clean Air Act for every batch train needed to produce a specific product.

SECTION 2.2 - CALCULATION OF EQUIPMENT UTILIZATION PERCENTAGES FOR EACH PIECE OF EQUIPMENT IN THE BATCH TRAIN NEEDED TO PRODUCE A SPECIFIC PRODUCT (STEP #2)

Step 2 of the PTE analysis can be completed by extracting from batch sheets the time needed to run each piece of equipment in every batch train. The following equation should be used to calculate percent utilization (i.e., percentage of time required for every piece of equipment for every product which can be produced in the batch train):

Equation 2.2:

Percent Utilization Product M =

$$\frac{[100\% \times (\text{Time in hours of individual piece of equipment})]}{[\text{Maximum hours for piece of equipment with the largest time}]}$$

A typical batch sheet is provided in Appendix A to illustrate the use of Equation 2.2. Note that the batch train for hypothetical Product H consists of a reactor, a centrifuge, and a dryer. Reaction, centrifugation, and drying times for Product H are 120, 240, and 120 hours, respectively. Therefore, using Equation 2.2, the percent utilization for the reactor is:

100% x 120/240, or 50%.

Similarly, percent utilizations for the centrifuge and dryer are 100% and 50%, respectively.

SECTION 2.3 - DETERMINATIONS INVOLVING INTERCHANGEABLE EQUIPMENT (STEP #3)

To complete Step 3, identify interchangeable or alternative equipment which can be substituted for equipment normally used to make a particular product by examining batch sheets. Referring to Appendix B, note that reactor R-6B and centrifuge C-4 can be substituted for reactor R-5 and centrifuge C-5.

SECTION 2.4 - TABULATION OF AER, PERCENT UTILIZATION, AND INTERCHANGEABLE EQUIPMENT DETERMINATIONS (STEP #4)

Step 4 can be completed by recording, in a Batch Percent Utilization/Emission spreadsheet, the AER values (from Step 1) for each product that emits a regulated pollutant. A blank form is provided in Appendix B. In the same spreadsheet, record percent utilization (Step 2) for each piece of equipment which makes up the batch train for a specific product and also indicate interchangeable equipment (Step 3). It should be noted that separate spreadsheets must be filled out for each hazardous air pollutant (HAP) and for each criteria pollutant. Examples are provided in Section 3 of this manual to help the user complete Step 4 of the procedure.

SECTION 2.5 - SELECTION OF PTE (STEP #5)

SECTION 2.5.1 - PTE FOR A SINGLE PIECE OF BATCH PROCESSING EQUIPMENT

PTE for a batch process which requires only a single piece of equipment (e.g., one reactor) is equal to the worst case Annual Emission Rate (AER) for that piece of equipment. Worst case AER is determined by first computing AER values for every product which can be produced in this piece of equipment and then by selecting the highest AER value. To summarize, PTE for a single piece of equipment is equal to the highest AER value and assumes that the product with the highest AER value will be the only product produced in that piece of equipment.

SECTION 2.5.2 - PTE FOR OTHER BATCH PROCESSING FACILITIES

PTE for batch processing facility with more than one piece of equipment must be determined by completing Step 5 of this procedure. To complete Step 5, examine the emissions and percent utilization data for each matrix generated in Step 4 and select maximum emissions for each pollutant by fully utilizing all available equipment which can be used to produce a particular product. Do not exceed 100% utilization for any piece of equipment. The examples in Section 3.0 will teach the user how to fill out a Batch PTE Spreadsheet. Please note that a blank PTE Batch Spreadsheet form is also provided in Appendix C.

SECTION 3 - MODEL PTE CALCULATIONS

A hypothetical custom chemical batch processing facility has 23 point sources which emit 3 HAPs (toluene, methanol and hexane) and one criteria pollutant (VOCs) during the manufacture of 21 products (identified as letters A through T.) To determine the applicability of Clean Air Act requirements such as Title V permitting, Reasonably Available Control Technology (RACT) standards, and Section 112 (g) for future modifications, this facility must determine its potential to emit and wishes to use the recommended calculation procedures.

3.1 Calculation of Toluene PTE

By following the calculation procedures and completing the Batch Percent Utilization Spreadsheet described in Section 2.4 above, we can see that, as indicated in Table 1A, toluene can be emitted from 7 batch reactors, 3 batch dryers, 3 batch centrifuges, and 1 thin film evaporator. Toluene is emitted in the production of 7 different products.

Product G is the largest emitter of toluene and requires batch reactor R-5 for the entire batch time (i.e., 100% utilization). Since reactors R-5 and R-6B are interchangeable, the maximum toluene emissions for process G is two (2) times the toluene emission rate for one train or 2 x 3.92 = 7.84 TPY. By making this worst case selection, we have tied up both reactors R-5 and R-6B 100% of the time. Therefore, no other process can be run or considered that requires these reactors. Consequently, only Processes C and F can be run concurrently with Process G since all other products require reactors R-5 or R-6B. By inspection, there is no equipment conflict between C and F, so they can be operated concurrently 100% of the time. Therefore, their toluene emissions are added to twice G's emissions to calculate a total toluene plant-wide potential to emit of 9.1 ton/year (see Batch PTE Spreadsheet Table 1B which also serves as a final equipment conflict check).

3.2 Calculation of Methanol PTE

As indicated in Table 2A, methanol can be emitted from 7 reactors, 3 centrifuges, 1 thin film evaporator, 4 dryers, and 2 ion exchange units. Methanol is emitted in the production of 9 different products.

By reviewing that Batch Percent Utilization Spreadsheet, we can see that Product H is the largest emitter of methanol and requires 1 batch reactor (R-5) 50% of the time, 1 dryer (D-4) 50% of the time, and 1 centrifuge (C-4) 100% of the entire batch time. However, reactor R-5 and dryer D-4 can be run 100% of the time if both centrifuges C-4 and C-5 are used. The maximum methanol emissions for Product H would then be two (2) times the methanol emission rate for one train (2 x 3.2 = 6.4 TPY).

By making this worst case assumption, we have tied up reactor R-5, centrifuges C-4 and C-5, and dryer D-4 100% of the time. Therefore, no other process can be run or considered that requires this equipment. Consequently, by inspection of Table 2A, Product J can be eliminated because it uses centrifuges C4 and C5. Process J s use of reactor R-5 would not itself eliminate process J because reactor R-6B is interchangeable. Product L can be eliminated because it uses centrifuge C5. Products I and O can be eliminated because they both require centrifuge C-4.

The highest methanol emitter for remaining processes (Products E, K, M and N) is Process K which requires reactor R-1, centrifuge C-2 and dryer D-6. Including Process K in the PTE calculation eliminates Products M and N which, respectively, utilize reactor R-1 and dryer D-6.

The only remaining methanol emitter is Process E which uses reactor R-5. Since reactor R-6B is available, Process E is included in the total methanol PTE calculations. Therefore, the methanol potential to emit can be calculated by summing emissions from Processes E, H, and K and is equal to 1.0 + 6.4 + 1.9 or 9.3 TPY (Table II-B).

3.3 Calculation of Hexane PTE

As indicated in Table 3A, hexane can be emitted from 8 batch reactors, 2 batch centrifuges, 1 still, 1 thin film evaporator, and 3 dryers. Hexane is emitted in the production of 9 different products.

By reviewing that Batch Percent Utilization Spreadsheet, we can see that Product S is the largest emitter of hexane and requires reactor R-1 and centrifuge C-4 100% of the time. Therefore, no other process can be considered that requires this equipment. Consequently, Products D, I, L, Q, and R can be eliminated because they all use reactor R-1.

By inspection, we can see that Product T is the next largest emitter of hexane and should be included in the total hexane PTE because it requires reactor R-6B 100% of the time. However, since reactor R-5 can also be used to produce Product T and there is "spare" capacity in both centrifuge C-5 and dryer D-1, an additional 13% of the time T can be run using reactor R-5. This limits out dryer D-1 at 100% of capacity. Therefore, dryer D-1 is at 94% utilization for Product T and centrifuge C-5 is at 33% utilization total (i.e., basic yearly batch x 1.13).

Product P is eliminated because there is 100 % utilization of dryer D-1 in making Products S and T. Since there is capacity in centrifuge C-5 to produce Product U concurrently with Products S and T, its emissions should be counted in the final hexane plant-wide PTE along with emissions from products S and T.

3.4 Calculation of Total HAP PTE

The total HAP PTE should be determined by first identifying the product with the largest (HAP) emission rate. In this case, Product S has the largest (HAP) emission rate (4.05 TPY of hexane) and fully utilizes reactors R-1 and centrifuge C-4. However, the third largest emitter of HAP is Product H which emits 3.2 TPY of methanol and which uses 50% of reactor R-5's, 100% of centrifuge C-4's, and 50% of dryer D-4's capacity. Product H's methanol emissions would be 6.4 TPY if reactor R-5, centrifuges C-4 and C-5, and dryer D-4 are run at 100% capacity. Since Product S's emissions are less than Product H's at full equipment utilization, Product H should be selected and Product S emissions should be eliminated from the worst case PTE calculation. Therefore, reactor R-5 and centrifuges C-4 and C-5, and dryer D-4 are fully utilized. Any product using any one of these pieces of equipment other than reactor R-5 can be eliminated from the total HAP PTE calculation (Products A, C, D, I, J, L, O, P, Q, S, T and U).

The second largest emitter of a HAP is Product G which can utilize reactor R-6B and which emits 3.92 TPY of toluene. Since there are no equipment conflicts, its HAP emissions will be included in the total plant-wide HAP PTE.

Products B (2.44 TPY toluene) and E (1.0 TPY methanol) are eliminated from the total HAP PTE calculation because they use reactors R-5 or R-6B, which are fully utilized to make Products G and H.

The next largest emitter of a HAP is Product K which emits 1.86 TPY of methanol and which fully utilizes reactor R-1 and dryer D-6. Since this equipment is not used to make Products G and H, Product K's emissions should be included in the total worst case HAP PTE calculation.

Products R is eliminated from the total HAP PTE calculation because it uses reactor R-1.

Product M (10.55 TPY methanol) is eliminated because it uses reactor R-1.

Products F and N are eliminated because they use dryer D-6 which is tied up in the production of Product K.

Therefore, the total HAP PTE is 12.2 TPY and is determined by adding emissions from Products G (3.9 TPY toluene), Product H (6.4 TPY methanol), and Product K (1.86 TPY methanol).

Table IA
PROCESSES WITH MAXIMUM TOLUENE EMISSIONS
* R-5 and R-6B interchangeable; C-4 and C-5 interchangeable

PRODUCT	**A**	**B**	**C**	**D**	**E**	**F**	**G**
AER (TPY)	0.11	2.44	0.67	1.35	1.84	0.56	3.92
<u>EQUIPMENT</u>	**<u>PERCENT UTILIZATION</u>**						
R-1		64.00		23.00			
R-3			44.00				
R-4		74.00					
*R-5	50.00			100.00	100.00		100.00
R-6A							
*R-6B	100.00	100.00					
R-7							
R-8		48.00					
R-12					24.00		
C-2							
*C-4	100.00		15.00	39.00			
*C-5	50.00						
S-1							
S-2							
S-4							
L-1		52.00	100.00		36.00		
D-1			44.00	16.00			
D-2	53.00						
D-4							
D-5							
D-6	50.00					100.00	
IE-1							
IE-2							

TABLE IB
TOLUENE POTENTIAL TO EMIT (PTE)

PRODUCT	**G**	**C**	**F**	**TOTALS**
EMISSIONS	7.84	0.67	0.56	9.07
EQUIPMENT	**PERCENT UTILIZATION**			
R-5	100.00			100.00
R-6B	100.00			100.00
D-6			100.00	100.00
R-3		44.00		44.00
C-4		15.00		15.00
L-1		100.00		100.00
D-1		44.00		44.00

TABLE IIA
PROCESSES WITH MAXIMUM METHANOL EMISSIONS
* R-5 and R-6B are interchangeable; C-4 and C-5 are interchangeable

PRODUCT	**E**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**
AER (TPY)	1	3.22	0.24	1.58	1.86	0.21	0.55	0.53	0.6
EQUIPMENT					**PERCENT UTILIZATION**				
R-1			57.00		100.00	82.00	43.00		65.00
R-3			100.00						
R-4									
*R-5	100.00	50.00		40.00		100.00			30.00
R-6A								20.00	
*R-6B						44.00			
R-7									
R-8							100.00		100.00
R-12	24.00			42.00		41.00			
C-2				83.00	33.00		71.00		15.00
*C-4		100.00	57.00	42.00					10.00
*C-5				42.00		47.00			
S-1									
S-2									
S-4									
L-1	36.00								
D-1				100.00		35.00	43.00		
D-2									
D-4		50.00							
D-5								72.00	
D-6			79.00		100.00			100.00	100.00
IE-1							67.00		90.00
IE-2									90.00

TABLE IIB
METHANOL POTENTIAL TO EMIT (PTE)

PRODUCT	H	K	E	TOTALS
EMISSIONS (TPY)	6.44	1.86	1.0	9.3
EQUIPMENT	PERCENT UTILIZATION			
R-1		100.00		100.00
R-5	100.00			100.00
R-6B			100.00	100.00
R-12			24.00	24.00
C-2		33.00		33.00
C-4	100.00			100.00
C-5	100.00			100.00
D-4	100.00			100.00
D-6		100.00		100.00
L-1			36.00	36.00

TABLE IIIA
PROCESSES WITH MAXIMUM HEXANE EMISSIONS
* R-5 and R-6B are interchangeable; C-4 and C-5 are interchangeable.

PRODUCT	**D**	**I**	**L**	**P**	**Q**	**R**	**S**	**T**	**U**
AER (TPY)	2.13	0.73	1.83	0.59	1.2	1.02	4.05	3	0.33
EQUIPMENT					**PERCENT UTILIZATION**				
R-1	23.00	57.00	82.00		100.00	92.00	100.00		
R-3		100.00			45.00	92.00	70.00		
R-4				38.00	9.00				
*R-5	100.00		100.00				57.00		
R-6A									
*R-6B			44.00					100.00	
R-7									
R-8					9.00				100.00
R-12			41.00			100.00			
C-2									
*C-4	39.00	57.00		100.00	44.00		100.00	29.00	48.00
*C-5			47.00				14.00		
S-1						92.00			
S-2									
S-4									
L-1						92.00			
D-1	16.00		35.00	100.00			6.00	83.00	
D-2									
D-4									91.00
D-5									
D-6		79.00			12.00				
IE-1									
IE-2									

TABLE IIIB
HEXANE POTENTIAL TO EMIT

PRODUCT	S	T	U	TOTALS
EMISSIONS (TPY)	4.05	3.4	0.33	7.8
EQUIPMENT		PERCENT UTILIZATION		
R-1	100.00			100.00
R-3	70.00			70.00
R-5	57.00	13.00		70.00
R-6B		100.00		100.00
R-7				
R-8			100.00	100.00
C-4	100.00			100.00
C-5	14.00	33.00	48.00	95.00
D-1	6.00	94.00		100.00
D-4			91.00	91.00

TABLE IV
TOTAL HAP POTENTIAL TO EMIT

PRODUCT	H	G	K	TOTALS
EMISSIONS (TPY)	6.44	3.92	1.86	12.22
EQUIPMENT	PERCENT UTILIZATION			
R-1			100.00	100.00
R-3				
R-4				
R-5	100.00			100.00
R-6A				
R-6B		100.00		100.00
R-7				
R-8				
R-12				
C-2			33.00	33.00
C-4	100.00			100.00
C-5	100.00			100.00
S-1				
S-2				
S-4				
L-1				
D-1				
D-2				
D-4	100.00			100.00
D-5				
D-6			100.00	100.00
IE-1				
IE-2				